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Serials Observations on oyster mortalities in the Maritime Provinces to the end of 1955 were described in Progress Reports of the Atlantic Coast Stations number 65. Since then, further heavy losses have occurred, but, at the same time, our understanding of the whole problem has improved. We can now forecast developments in affected areas and we think we have an effective method of hastening the recovery of devastated areas. The purposes of this report are to bring the account of mortalities up to date and to describe the method of rehabilitation.

This circular is available in both the English and French language.

#### MORTALITY IN PRINCE EDWARD ISLAND

In October, 1955, complaints were received that oysters from some of the best beds in central Malpeque Bay were too thin for satisfactory marketing. Ordinarily oysters from these beds are of such high quality at that time of year as to command premium prices. Investigation at the time showed that summer shell growth had been apparently normal but that the meats of about one-quarter of the oysters were in fact very thin. Growers stated that oysters shipped in September from these same beds were in prime condition for that month. This suggested a loss in condition during October, but nothing further could be discovered at the time.

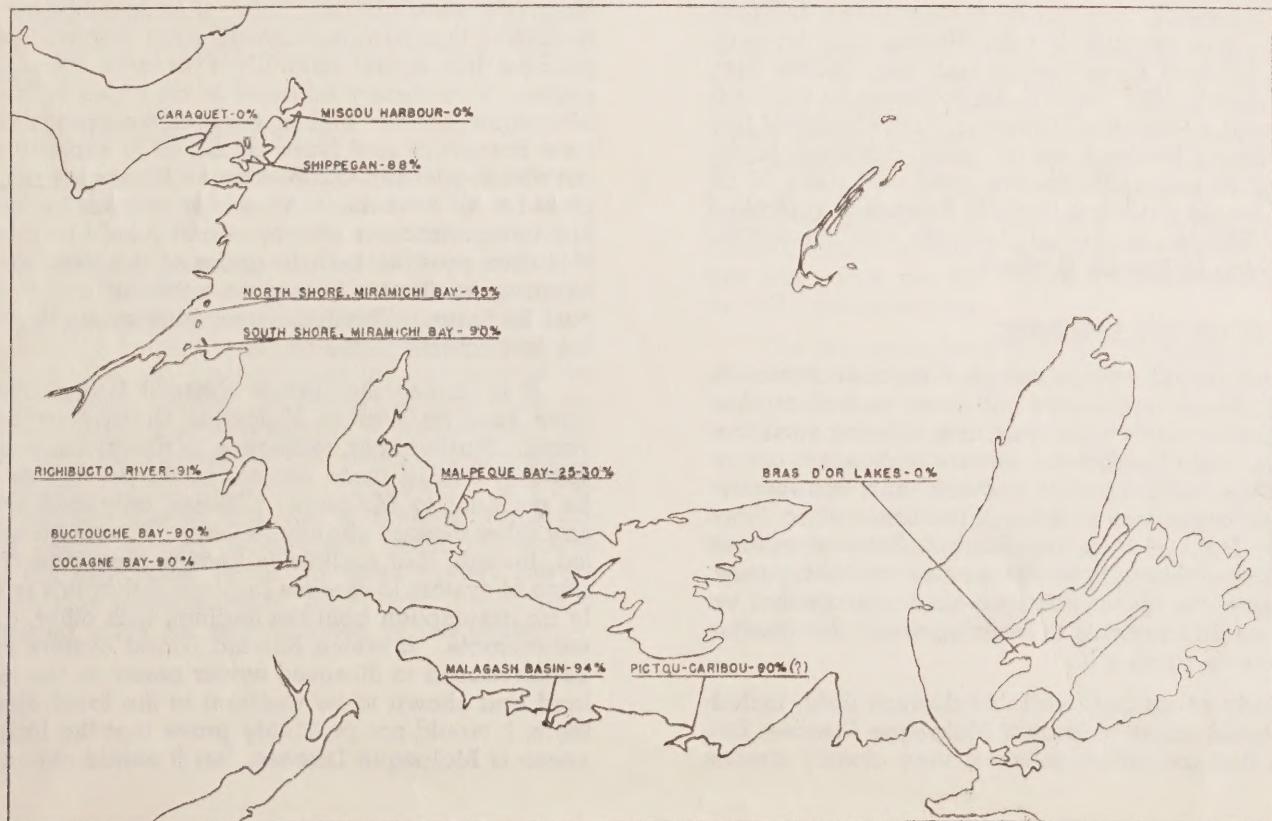
By May, 1956, a mortality of 25-30% had occurred on the affected beds, as compared to a normal 4% on neighbouring, unaffected beds. High mortalities occurred nowhere else in Prince Edward

Island and continued observation of this one showed that it had run its course by the time it was discovered in May. Surviving oysters grew normally in 1956 and fattened satisfactorily for market in the fall.

The cause of this mortality over the winter of 1955-56 in such a restricted locality is unknown but, because of its short duration, local nature and comparatively low death rate it is not considered to be epidemic disease. Rather it is thought to be related in some way to prevention of normal fattening of some oysters in October, 1955, resulting in their inability to survive the ensuing winter. This loss seems to have been in no way connected with the simultaneous wholesale mortalities that are taking place on the mainland.

#### EPIDEMICS IN NEW BRUNSWICK AND NOVA SCOTIA

During the spring, summer and fall of 1956 oyster beds in all important producing areas of these provinces were examined for mortalities. In addition test trays of local stock were regularly examined at Shippegan and in Miramichi Bay in New Brunswick and at Malagash and in the Bras d'Or Lakes in Nova Scotia. The resulting information on deaths, added to what we already knew has been expressed in terms of the per cent of the original stock that has died to the end of 1956. This is shown on the map in the accompanying figure. It is also set down in the table below, together with other information to be referred to later.



Percentages of original oyster stock lost in recent mortalities in important producing areas of the Maritimes.

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## Classification of Oyster Areas with Respect to Disease

Area	Percentage of original stock killed, to end of 1956	Year disease commenced	Forecast for 1957
Caroquet Bay, N. B.	0	—	No heavy mortalities, but susceptible.
Miscou Harbour, N. B.	0	1956 (?)	A doubtful area. There were some symptoms of disease in late 1956, but the oysters have held well in storage. Forecast: either no heavy mortalities, but susceptible or 40% mortality.
Shippegan, N. B.	88	1954	No further heavy mortalities among survivors, except in areas which the disease is just reaching, e. g. Lameque Bay.
North Shore			
Miramichi Bay, N. B.	45	1955	Further 40% mortality.
South Shore			
Miramichi Bay, N. B.	90	1954	No further heavy mortalities among survivors.
Richibucto River, N. B.	91	1954	No further heavy mortalities among survivors.
Buctouche Bay, N. B.	90	1952 or 1953	Heavy mortalities were all over here by 1954 or 1955. Population should increase.
Cocagne Bay, N. B.	90	1950, 1951 or 1952	Heavy mortalities were all over here by 1952, 1953 or 1954. Population should increase.
Malagash Basin, N. S.	94	1954	No further heavy mortalities among survivors.
Caribou-Pictou, N. S.	?	1954 or 1955	This area was not examined; lessees report: "All oysters dead." Depending on what this means: either no further mortalities among survivors or else a further 40% mortality.
Bras d'Or Lakes, N. S.	0	—	No heavy mortalities, but susceptible. This area has few oysters, probably because of starfish depredation.

It will be seen that the trend has been toward continuation of epidemics already reported, with the exception of the new mortality on the north shore of Miramichi Bay. It is also apparent that the sole remaining disease-free areas of any commercial importance are Caraquet Bay and Miscou Harbour in New Brunswick and the Bras d'Or Lakes in Nova Scotia. It is possible that the disease may have already infected these areas and that deaths may commence in 1957, but it is not probable on the basis of present information. However, both Caraquet Bay and Miscou Harbour are in close proximity to the heavily diseased Shippegan area and there is already ample evidence that the disease is spreading along Shippegan Island towards the susceptible population in Miscou Harbour.

## NATURE OF THE DISEASES

Because the symptoms of all reported oyster diseases are so similar, the only sure method of identification is to isolate the organism causing each one. It seems probable that the disease or diseases of oysters in the Maritimes are bacterial and that the one or more organisms causing them are among those already isolated from the blood of diseased oysters. The proof of this is, however, so slow and the present position of the oyster fishery is so desperate that we have sought short cuts in learning about the disease and how to combat it.

Study of all our available disease data, including several cases of known Malpeque Disease, has shown that mortalities follow a very closely similar

pattern. Very few oysters in a susceptible population die in the year in which they are first exposed to disease, but mortalities of about 30-40% occur in the following summer and again in the winter following that. This gives a total mortality at this last mentioned time of about 90% of the original stock. Very few more die after this. It is possible but improbable, that two or more different disease would produce this model faithfully time after time. The pattern is so closely followed in all cases of known Malpeque Disease and in each of the epidemics in New Brunswick and Nova Scotia as to strongly support the suggestion that Malpeque Disease is responsible for all of them. This is our present belief. If this interpretation is correct — and it held in 1956 — it is thus possible both to guess at the year of first exposure to disease in a given epidemic and to forecast its future. This has been done and entered in the last column in the table.

It is known that Prince Edward Island oysters have been resistant to Malpeque Disease for many years. Furthermore, resistance to disease is usually specific, that is, these oysters could be expected to be resistant to Malpeque Disease only and not to any other disease strange to them. It must be admitted, though, that so little is known about the resistance of oysters to disease in general that this is really an assumption from the findings with other, different animals. If Prince Edward Island oysters could be introduced to diseased oyster areas on the mainland and shown to be resistant to the local disease there, it would not positively prove that the local disease is Malpeque Disease, but it would strengthen

the case for this claim. Also, if Prince Edward Island oysters survive, spawn and produce resistant young in these areas, the practical problem of rehabilitation would be solved, regardless of the doubt about the scientific exactness of the answer. Such experiments are now under way.

### RESISTANCE EXPERIMENTS IN NEW BRUNSWICK AND NOVA SCOTIA

In August, 1956, three trays, each containing 200 Prince Edward Island oysters, were introduced to the disease-ridden waters of South St. Simon Inlet, near Shippegan, N. B., and identical lots were placed in Richibucto River, N. B., and in Malagash Basin, N.S. In each case duplicate trays containing susceptible Bras d'Or Lakes oysters, as controls, were also exposed to these diseased waters. Deaths in all trays have been closely followed. By the end of 1956 these figures were about 1% in each tray. Such results prove nothing, but they do agree with the expected low mortality in the first year of exposure. If Bras d'Or Lakes oysters are susceptible and Prince Edward Island oysters resistant to the local disease in each case, it is expected that, by the end of August or early September 1957, a further 30-40% of Bras d'Or Lakes oysters and not more than 10% of Prince Edward Island oysters will have died. If the actual mortalities are markedly different from this expectation, the assumption that Malpeque Disease is responsible for all epidemics will have to be revised.

Since Prince Edward Island oysters are believed to carry Malpeque Disease, this experimental transfer and any more transplants of Prince Edward Island stock involve the danger of transferring Malpeque Disease to the mainland. However, mainland oyster stocks are now so low and the probability that the Malpeque Disease is involved is so high that this risk has been accepted by federal and provincial authorities.

### REHABILITATION TRANSFERS

In the original outbreak in 1915 in Malpeque Bay the period of recovery of the fishery to its former level was about 20 years. By contrast in the 1935 Charlottetown epidemic this period was about 10 years. In the latter case resistant Malpeque spat were transferred to the Charlottetown area by lessees and it is believed that this was largely responsible for shortening the period of the recovery of the fishery. In the hope of duplicating or improving upon this performance, the federal Department of Fisheries, with the consent of the provincial authorities concerned, has undertaken to transplant 10,000 barrels (25,000 Imperial bushels) of mature Prince Edward Island oysters to diseased mainland waters over the next three years. If these oysters are resistant, it is expected that they will constitute a spawning stock for rehabilitation of the fishery.

The first transplant, in the spring of 1957 will transfer 1,000 barrels to the Shippegan area and 500 barrels to Malagash Basin. These transfers will actually precede by two to four months the earliest date on which the results, on which they should be based, will be available from the resistance experiments described. This is unsound, but the decision to go ahead reflects both the urgency of doing anything, as soon as possible, that is in the least promising and the confidence that is placed in this project. If the results of the resistance experiments are discouraging, further rehabilitation transfers will be reconsidered. If, on the other hand, the experimental results should turn out favourably, it would mean a full year's gain in the rehabilitation of the Shippegan and Malagash areas, as well as indicating that the rest of the transfers can go ahead.

### PROSPECTS FOR THE MAINLAND FISHERY

The combined production of New Brunswick and Nova Scotia has fluctuated in recent years before the epidemic, but averaged about 30,000 barrels annually. In 1956 it was 7,630 barrels. In 1957 it will be still lower, as diseased areas go out of production entirely. The remaining disease-free areas of any importance are Caraquet Bay and Miscou Harbour, N. B. and the Bras d'Or Lakes, N. S. If they all remain healthy, their annual production will be something as follows:

Caraquet Bay	1500	barrels
Miscou Harbour	500	"
Bras d'Or Lakes	1500	"
Total for N. B. and N. S.		3500 "

The strong demand for poor shapes at good prices, which developed due to the shortage in 1956, is expected to continue. This may lead to intensive fishing of many small, poor areas and raise the above figures somewhat. On the other hand spread of the disease to any of the big healthy areas would wipe out the fishery concerned. If natural, unassisted recovery must take place on the mainland, this 3,500-barrel annual production is the most optimistic outlook for the next ten years, with slow recovery to the level of former production in a further ten years. If resistance experiments and mass transfers are successful, annual production will be no greater for the first few years, but the recovery period may be cut in half, or slightly less.

The prospects for this latter prophecy are considered so good that lessees in devastated areas are being urged to retain their holdings as sanctuaries for the introduced Prince Edward Island spawning stock. This period also represents a time when growers in Prince Edward Island and in undiseased areas of the mainland should be making every effort to increase production to fill the gap left by the disappearance of most mainland fisheries. This could be a very profitable undertaking at the high 1956 prices, which are expected to continue.

